

## Mathematics (COST)

### MATH 1101- Introduction to Mathematical Modeling

Mathematical modeling using graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. The investigation and analysis of applied problems and questions, and effective communication of quantitative concepts and results. Topics include linear, quadratic, polynomial, exponential and logarithmic models of real-world phenomena. Credit cannot be earned toward graduation for MATH 1111 if credit is earned for MATH 1101. Prerequisite: Two years of high school algebra or equivalent.

### MATH 1111-College Algebra

A functional approach to algebra that incorporates mathematical modeling of real data, business applications and use of appropriate technology. Emphasis will be placed on the study of linear, quadratic, piece-wise defined, rational, polynomial, exponential and logarithmic functions. Credit cannot be earned toward graduation for [MATH 1101](#) if credit is earned for [MATH 1111](#). Prerequisite: Two years of high school algebra or equivalent.

### MATH 1112-Trigonometry

Circular functions, solutions of triangles, trigonometric identities and equations, graphs of trigonometric functions, Law of Sines, Law of Cosines, applications, vectors, matrices, complex numbers, Euler's formula, DeMoivre's theorem. Appropriate technology will be used. Credit may not be received for both [MATH 1112](#) and [MATH 1113](#). Prerequisite: A minimum grade of "C" in [MATH 1111](#) or equivalent.

### MATH 1113-Pre-Calculus

Emphasizes trigonometric functions and concepts and will include a review of selected topics from algebra including systems of equations and matrix algebra. The graphing calculator will be incorporated throughout the course. Prerequisite: A minimum grade of "C" in [MATH 1111](#) or equivalent.

### MATH 1232-Survey of Calculus

Covers the fundamental elements of differential and integral calculus of algebraic, logarithmic and exponential functions. Topics include a brief review of algebraic principles, limits, derivatives and integrals. Appropriate technology will be incorporated throughout the course. Prerequisite: A minimum grade of "C" in [MATH 1111](#) or [MATH 1113](#) or equivalent.

### MATH 1441-Calculus I

This is the first of a sequence of courses which present a unified treatment of the differential and integral calculus. Topics include: limits, continuity, differentiation and integration, applications of the derivative and the integral. Prerequisite: A minimum grade of "C" in [MATH 1112](#) or [MATH 1113](#), or equivalent.

### MATH 2008-Foundations of Numbers and Operations

This course is an Area F introductory course for early childhood education majors. This course will emphasize the understanding and use of the major concepts of numbers and operations. As a general theme, strategies of problem solving will be used and discussed in the context of various topics. This course is also part of the program of study for middle grade majors. Prerequisite: A minimum grade of "C" in [MATH 1111](#).

### MATH 2010-Problem Solving for K-8 Teachers

Students will learn, integrate and apply a variety of problem solving strategies to a range of mathematical problems from algebra, geometry and other areas of mathematics appropriate to the middle grades curriculum. Students will learn, integrate and apply appropriate technology as a tool in the problem solving process. For early childhood and middle grade majors only. Prerequisite: A minimum grade of "C" in [MATH 3032](#).

### MATH 2130 -Discrete Mathematics

Covers important discrete mathematical objects such as sets, relations and functions, graphs and trees. An introduction to mathematical logic and reasoning, and the concept of an algorithm and its complexity will be covered. Prerequisites: Prior or concurrent enrollment in [MATH 1232](#), or a minimum grade of "C" in [MATH 1111](#) or any mathematics course that has [MATH 1111](#) as a prerequisite.

### MATH 2242/2242H-Calculus II

Includes an introduction to transcendental functions, techniques of integration, improper integrals, infinite series and conics. Prerequisite: A minimum grade of "C" in [MATH 1441](#) or equivalent.

### MATH 2243-Calculus III

Topics in real valued functions of several variables. Topics include polar coordinates, parametric equations, vectors in two and three dimensions, quadric surfaces, partial derivatives and applications, multiple integrals and applications, line integrals and Stoke's and Green's theorem. Prerequisite: A minimum grade of "C" in [MATH 2242](#) or equivalent.

### MATH 2331-Elementary Linear Algebra

Matrices, solutions of linear systems, vector spaces and subspaces, orthogonality, determinants, eigenvalues and eigenvectors, linear transformation, diagonalization, and applications. Prerequisite: A minimum grade of "C" in [MATH 2242](#).

### MATH 2332-Mathematical Structures

Topics include mathematical logic, methods of proofs, induction, set theory, relations, and functions. The course is primarily intended for mathematics and mathematics education majors as a first course in studying proof techniques and foundations of mathematics. Prerequisite: A minimum grade of "C" in [MATH 2242](#).

### MATH 2430-Computing Techniques

Fundamentals of numerical methods and development of programming techniques with implementation in the computer solution of problems in engineering. Prerequisites: [CSCI 1301](#) or [ENGR 1731](#), [MATH 2242](#), [PHYS 2211](#). Corequisite: [MATH 3230](#).

### MATH 3032-Foundations of Data Analysis and Geometry

A study of basic probability, statistics and geometry, including two and three dimensional shapes and triangle congruenced similarity. For Early Childhood and Middle Grade majors only. Prerequisite: A minimum grade of "C" in [MATH 2008](#).

### MATH 3130-College Geometry

A study of absolute and Euclidean geometry. Prerequisite: [MATH 2332](#).

### Math 3230-Ordinary differential equations

The study of differential equations involving functions of one variable. Topics include: linear and non-linear differential equations, initial value

problems, existence and uniqueness theorems, systems of differential equations, stability, computational methods and Laplace transform methods. Prerequisite: Math 2242

#### MATH 3337-Probability

An introduction to probability, random variables and discrete and continuous probability distributions for students in mathematics, engineering and the sciences including the social sciences and management science. Prerequisite: A minimum grade of "C" in [MATH 2242](#) or equivalent.

#### MATH 4890-Directed Study in Mathematics

Directed study under faculty supervision. Well prepared math majors may be permitted to enroll in an independent study upon the recommendation of a Mathematics faculty member. Prerequisite: Permission of instructor and department chair.

#### MATH 4910 Undergraduate Seminar

A specialized study of various topics in mathematics with the intention to engage students in independent reading, writing and presentation of these topics under the supervision of mathematics faculty. Prerequisites: Math 2332 and Math 2243.

#### MATH 493 -Senior Research Project

Main objective of this course is to engage senior undergraduate students in mathematical, statistical or computer science research and writing. Students will select advisors to work with on their projects. At least one oral presentation on the progress of their research during the semester is required. Also, a final written report on the project as well as a final oral presentation is required. Prerequisite: Students must have at least 15 credit hours of upper level mathematics, statistics and/or computer science.

#### MATH 5090-Selected Topics in Mathematics

Specialized study in a selected area of Mathematics. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Prerequisite: Permission of instructor.

### MATH 5130-Statistics and Probability for K-8 Teachers: 3-0-3

An in-depth study of topics in statistics, such as sampling and data analysis, and probability, such as counting methods, odds, and expected value. For Early Childhood and Middle Grade majors only. Prerequisite: [MATH 3032](#).

### MATH 5135-Algebraic Connections for K-8 Teachers

The evolution of algebraic concepts through the curriculum will be followed by how algebra is related to other areas of mathematics and real-world applications. For Early Childhood and Middle Grade majors only. Prerequisite: [MATH 3032](#).

### MATH 5136-History of Mathematics

A survey of the historical development of mathematics. The emphasis will be on mathematical concepts, problem solving, and pedagogy from a historical perspective. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Prerequisite: [MATH 2242](#) or permission of instructor.

### MATH 5137-Geometry for K-8 Teachers

A continuation of the study of geometry from MATH 3032. Focus will be on two and three dimensional geometry. Motion geometry and tessellations will also be covered. For Early Childhood and Middle Grade majors only. Prerequisite: A minimum grade of "C" in [MATH 3032](#).

### MATH 5230-Advanced Geometry

Selected topics from Euclidean and Non-Euclidean Geometry. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Prerequisite: [MATH 3130](#) or one year of teaching high school mathematics.

### MATH 5232-Mathematical Applications Using Technology

Selected mathematical topics used in research, problem solving, and demonstrations will be investigated with the use of current technologies. Intended for mathematics education majors. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Prerequisite: [MATH 2243](#) and 3 hours of mathematics at the junior level or above.

### MATH 5234 NUMBER THEORY

Introduction to the principal ideas of elementary number theory: Divisibility, congruencies, linear Diophantine equations, Fermat's theorem, Euler's theorem, Pythagorean triple and the distribution of primes. Prerequisite: MATH 2332 (Mathematical Structures)

### MATH 5236-Patterns of Problem Solving

A study of patterns involved in solving problems. Particular attention is paid to Polya's heuristics and his characterization of the problem solving process. The student will also solve many problems. The application of these techniques by mathematics teachers will be stressed. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Prerequisite: [MATH 1441](#) or permission of instructor.

### MATH 5330 OPERATIONS RESEARCH

Introduction to the basic deterministic and probabilistic operations research models of decision problems. Mathematical methods of optimization for these models will be analyzed both analytically and numerically. Prerequisite: MATH 3337 (Probability)

### MATH 5331 ANALYSIS I

Provides a transition from calculus to real analysis. Emphasis will be placed on understanding and constructing mathematical proofs. Rigorous development of fundamental concepts in analysis, including topics such as relations, functions, limits of functions, cardinality, topology of the reals, completeness axioms, compact sets, sequences, subsequences, continuity and differentiability. Prerequisites: MATH 2243 (Calculus III) and MATH 2332 (Mathematical Structures)

### MATH 5332 ANALYSIS II

A continuation of Analysis I, including topics such as Riemann integration, infinite series, sequences and series of functions, metric spaces and normed spaces. Prerequisite: MATH 5331 (Analysis I)

### MATH 5333 MODERN ALGEBRA I

An introduction to the fundamental algebraic structures: groups, rings and fields. Topics covered include: binary operations, groups (permutation

groups, subgroups, cyclic groups, group homomorphisms, factor groups), rings (integral domains, ring homomorphisms) and fields. The historical and mathematical connections to the secondary mathematics curriculum will be incorporated as appropriate. Prerequisite: MATH 2332 (Mathematical Structures)

#### MATH 5334 MODERN ALGEBRA II

A continuation of the study of the fundamental algebraic structures. Topics to be covered include: isomorphism of groups, rings, fields, a deeper study of quotient structures and the isomorphism theorems, field of quotients, factorization of polynomials over a field, arithmetic properties of rings of polynomials over fields, extension fields, algebraic extensions, geometric constructions and the classic problems. Prerequisite: MATH 5333 (Modern Algebra I)

#### MATH 5334-Modern Algebra II

A continuation of [MATH 3333](#). Applications and deeper properties of the fundamental algebraic structures, isomorphisms of groups, rings and fields, quotient structures, vector spaces and Euclidean constructions. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do. Prerequisite: [MATH 3333](#).

#### MATH 5335 INTERMEDIATE LINEAR ALGEBRA

General vector spaces and bases, linear operators, least squares problems, eigenvalue problems, and applications of these concepts. Prerequisites: MATH 2331 (Elementary Linear Algebra) and MATH 2332 (Mathematical Structures)

#### MATH 5336 APPLIED NUMERICAL METHODS

Introduction to scientific computation on digital computers. Solution of nonlinear equations and systems of linear and nonlinear equations, polynomial interpolation, numerical differentiation and integration, data fitting and other numerical methods. Prerequisites: MATH 2331 (Elementary Linear Algebra) and knowledge of a programming language.

#### MATH 5337 DIFFERENCE EQUATIONS

An introduction to the theory and applications of difference equations. Topics include the difference calculus, first order linear difference equations, results and solutions of linear equations, applications, equations

with variable coefficients and nonlinear equations that can be linearized. Prerequisites: MATH 2242 (Calculus II) and MATH 2331 (Elementary Linear Algebra)

#### MATH 5338 METHODS OF APPLIED MATHEMATICS

Methods of applied mathematics concentrating on techniques for the analysis of differential and integral equations. Topics include: Integral equations, differential operators, Fredholm alternative, distribution theory and Green's function methods. Prerequisites: MATH 2331 (Elementary Linear Algebra) and MATH 3230 (Differential Equations)

#### MATH 5339 PARTIAL DIFFERENTIAL EQUATIONS

The study of differential equations involving functions of more than one variable. Topics include: Laplace, heat and wave equations, boundary value problems, methods of separation of variables and eigenfunction expansions, Fourier series, Green's functions, maximum principle and computational methods. Graduate students will be given an extra assignment not required of undergraduate students. Prerequisites: MATH 2243 (Calculus III) and MATH 3230 (Differential Equations)

#### MATH 5430 INTRODUCTION TO MATHEMATICAL BIOLOGY

An introduction to applications of mathematics to various biological, ecological, physiological, and medical problems, which will be analyzed both analytically and numerically. Prerequisite: MATH 3230 (Differential Equations) or permission of instructor.

#### MATH 5431 COMBINATORICS AND GRAPH THEORY

The course covers basic theory and applications of combinatorics and graph theory. Combinatorics is a study of different enumeration techniques of finite but large sets. Topics that will be studied include principle of inclusion and exclusion, generating functions and methods to solve difference equations. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm. Prerequisites: MATH 2332 (Mathematical Structures) and MATH 3337 (Probability)

### MATH 5433 DIFFERENTIAL GEOMETRY OF CURVES AND SURFACES

Differential geometry uses tools from calculus and linear algebra to study the geometric properties of smooth curves and surfaces in Euclidean spaces. Topics include: arc length, surface area, geodesics, curvature, first and second fundamental forms, Gauss-Bonnet formula. Prerequisites: MATH 2243(Calculus III) and MATH 2331(Elementary Linear Algebra)

### MATH 5434 FUNCTIONS OF A COMPLEX VARIABLE

Topics in complex variables including functions, limits, derivatives, integrals, the Cauchy-Riemann conditions, series representation of functions, Cauchy Integral formula and elementary conformal mappings. Prerequisite: MATH 2332 (Mathematical Structures).

### MATH 5435 INTRODUCTION TO TOPOLOGY

An introduction to metric spaces, topological spaces, connectedness and compactness of topological spaces, and continuous functions on topological spaces. Prerequisite: MATH 2332 (Mathematical Structures).

### MATH 5436 INTRODUCTION TO FRACTALS

Fractals as nonlinear systems involving feedback and iteration. Classical fractals, Limits and self-similarity. Fractal dimensions. Encoding of fractals. Decoding of fractals. Iterated function systems. Prerequisites: MATH 2243 (Calculus III), MATH 2332 (Mathematical Structures) and MATH 5335 (Intermediate Linear Algebra).

### MATH 5437 MATHEMATICS OF COMPUTER-AIDED DESIGN

The study of the theory and techniques used for the computer generation of curves and surfaces. Topics include Bernstein/Bezier and B-spline curves and surfaces, transformations and projections, affine spaces and maps, geometric continuity, curvature, subdivision and interpolation. This course is recommended for students in mathematics, engineering and computer science. Prerequisite: MATH 2242 (Calculus II).

### MATH 5530-Mathematics for Scientists and Engineers

A survey of mathematical topics useful in the study of areas of applied sciences such as physics, engineering and computer science. Topics include: linear algebra and matrices, ordinary differential equations, partial differential equations, Fourier series, vector calculus, complex variables, numerical methods, probability and graph theory. For non-math majors

only. Graduate students will be given an extra assignment not required of undergraduate students.

Prerequisite: Math 2242

### MATH 5539 MATHEMATICAL MODELS

This course introduces students to a variety of mathematical tools used for solving real world problems, with the focus on identifying the problem, constructing an appropriate model, and finding the best available method to solve it. Prerequisites: MATH 2331 (Elementary Linear Algebra) and MATH 3230 (Differential Equations)